No.

Water and Sanitation Agency
FDA, Faisalabad
Islamic Republic of Pakistan

IMPLEMENTING REVIEW STUDY REPORT
ON
THE PROJECT FOR THE EXPANSION
OF
WATER SUPPLY SYSTEM
IN
FAISALABAD
IN
ISLAMIC REPUBLIC OF PAKISTAN

March 2010

JAPAN INTERNATIONAL COOPERATION AGENCY

JAPAN TECHNO CO., LTD.

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PREFACE

Japan International Cooperation Agency (JICA) conducted the implementing review study on the Project for the Expansion of Water Supply System in Faisalabad in the Islamic Republic of Pakistan.

JICA sent to Pakistan a survey team from 9th December 2009 to 25th December 2009.

The team held discussions with the officials concerned of the Government of Pakistan, and conducted a field study at the study area. After the team returned to Japan, further studies were made. Then, a mission was sent to Pakistan in order to discuss a draft outline design, and as this result, the present report was finalized.

I hope that this report will contribute to the promotion of the project and to the enhancement of friendly relations between our two countries.

I wish to express my sincere appreciation to the officials concerned of the Government of the Islamic Republic of Pakistan for their close cooperation extended to the teams.

March 2010

Shigenari Koga
Director General
Financing Facilitation
and Procurement Supervision Department
Japan International Cooperation Agency

March 2010

LETTER OF TRANSMITTAL

We are pleased to submit to you the implementing review study report on the Project for the Expansion of Water Supply System in Faisalabad in the Islamic Republic of Pakistan.

This survey was conducted by Japan Techno Co., Ltd, under a contract to JICA, during the period from November 2009 to March 2010. In conducting the survey, we have examined the feasibility and rationale of the project with due consideration to the present situation of Pakistan and formulated the most appropriate outline design for the project under Japan's grant aid scheme.

Finally, we hope that this report will contribute to further promotion of the project.

Very truly yours,

Toshimichi Naganuma
Project Manager
Implementing Review Study Team
The Project for the Expansion of Water Supply System in Faisalabad in the Islamic Republic of Pakistan
Japan Techno Co., Ltd.

SUMMARY

Summary

The Islamic Republic of Pakistan (hereafter called “Pakistan”) lies in the southwestern Asia, bordering on India to the east, on Iran and Afghanistan to the west and facing the Arabian Sea to the south, occupying a total area of 796 thousand km^2. Its estimated population in 2008 was close to 166 million (World Bank), about 2/3 of which is the rural population as agriculture is still one of the main stays of the country’s economy. Faisalabad, city targeted by this project, is located in the central area of Punjab province developing a national granary thanks to the dense canal network from the Indus river and its tributaries. According to the latest census in 1998, its population reached the third largest level in the country only behind Karachi and Lahore, and in 2009 is estimated at about 2,800 thousand. At its birth in 1960s, the place was intended to serve as a distributing center of agricultural products in neighborhoods. It was not long before the city saw the textile industry settled in the town, eventually developing as one of the country’s largest industrial cities.

The country’s GDP dramatically picked up in the recent years, with its growth rate sustained at a high level of 7% on average for nearly 5 years, driven by the strong influence of dynamic neighboring Asian countries, especially China and India. In 2007, however, it saw an abrupt economic slowdown, facing spiraling inflation, sharp stock price fall, withdrawal of investments, etc., due to the intense imbalance of international payments caused by the rampant global financial crisis. Then the government hurriedly worked out a plan for stabilization of domestic demand to look to IMF, which agreed to offer 7.6 billion US dollars as relief. As a result, the country is now following a policy of austerity and economic reform under the IMP programme. At the turn of the century when the economic situation looked dire, the nation’s poverty headcount was estimated at 32.1%, and the Pakistani government issued its poverty reduction strategy papers in 2003 for sustainable development of economy and poverty reduction focused on the improvement in rural areas. Although the recent robust economy raised individual income, leading to the improvement of MDG’s (Millennium Development Goals) indicators, poverty seems again surging, reversing the trend. Many of those in rural areas fled to large cities such as Karachi (now with a population of about 10 million), Lahore (6 million) and Faisalabad (2.5 million), most of them living in shanty towns there. Now about 50% of the urban population reportedly crowds the country’s 7 largest cities with one third of them living under the poverty line. Such a large influx of immigrants has inevitably squeezed fragile infrastructure of cities, leaving their social services deteriorated.

In 1970s, ADB undertook a project for the improvement of environmental infrastructure of Faisalabad city for water supply and sewerage components, starting with preparation of a master plan to meet the demand of its rapid growth. , The planned facilities for water and sewerage services in its Phase 1 were finally completed in 1992, including 25 tubewells along the Chenab River, a tributary flowing in the southwestern direction from the Indus River, approximately 30km north of the city. The project established a comprehensive water supply system, including 25 tubewells, 20km long transmission

pipeline to transfer the water from the wellfield to the city, the terminal reservoir and the city distribution network of 45km in total length.

Immediately after its completion, however, the city authorities saw urgent necessity to expand them, as the city had increasingly grown larger during the lapse of time, and the initial master plan by ADB was revised with assistance of the World Bank in 1993. A request for assistance for "the Project for Improvement of Water Supply Facilities in Faisalabad" was then submitted to Japan in 1995, based upon the programme of the revised master plan. Since then, cooperation by Japan for the project in response to the Pakistani request was interrupted from time to time during the course of its implementation due to the continuing political and social disorder of the country and the rampant global economic turmoil. In 2009, however, the bid for the major components of the "Project for Improvement of Water Supply System in Faisalabad" turned out successful, and their construction works have now been in progress. Under such circumstances, this implementation review study is aimed at examining the details for the realization of water source component, which was agreed in 2009 by both governments to be separately undertaken later in an independent project entitled "the Project for the Expansion of Water Supply System in Faisalabad". The entire system of the initial plan for a new water supply system for the city is to be completed with the realization of this remaining component for water source facility.

The components of existing water supply system for Faisalabad remain nearly the same as they were completed in 1992 through the execution of the preceding ADB project. Consequently the ongoing service has extremely been degraded due to the acute shortfall of water quantity for supply, which has been far short of ever increasing demand of citizens. Moreover the poor condition of the city’s sewerage facilities tends to threaten their health and environment, frequently causing contamination of drinking water through defective pipelines. As citizens are thus exposed to incessant risk in the basic necessities, their concern has been mounting.

Poor service in the water sector was not only limited to Faisalabad. It was widespread across the main cities of the province. As the situation worsened, the provincial government carried out in 2005 the survey of urban environment in the province by the team from the World Bank. The team found that the average rate of connections to municipal water and sewerage services in 9 largest cities in the province were 55% and 57% respectively. According to its in-depth study through the household survey, those who had no connections to the water service looked to their own private water wells. Even 90% of those having connections depended upon their own water wells together with the municipal service or as their main sources, since the ongoing service had always been unreliable. In Faisalabad groundwater resources within the city area are not suitable for drinking purpose since they not only contain more salt than those in other 8 cities, but also contaminants of waste waters from industry or defective sewers. A great number of citizens, therefore, protect their health buying water for drinking purpose. Hearing from citizens by this project reported that they were afraid of rampant water borne diseases such as hepatitis, diarrhea, etc.

Meanwhile the federal government had been under pressure of rising demand nationwide for improvement of the water sector. In 2005 it announced a new sector policy in the "Medium Term Development Framework" (hereafter called "MTDF", 2005～2010) as an elaborate sector programme of the 10 Year Development Plan (2001～2010), in which the government pledged increased investment for the water sector. “National Drinking Water Policy” (hereafter NDWP) distributed as a draft by the Ministry of Environment in 2005 was aimed at developing the strategy of MTDF, and was eventually approved by the National Assembly in 2009. The goal of NDWP is to provide safe drinking water to the entire nation by 2025, defining the framework of responsibilities for the sector development, in which the respective provincial governments play a main role for the establishment of administrative and legal procedures and for the provision of financial arrangements. Encouraged by these policies of MTDF and NDWP, the Punjab provincial government has launched to provide guidance to WASAs (Water and Sanitation Agencies) in 6 major cities, including Faisalabad, and authorities of towns and other administrative units. For the urban water sector, it worked out a policy named “Roadmap for Improving Water and Sanitation Service”, in which the investment required for rehabilitation of urban facilities was estimated to amount to 750 million US dollars for 5 years. The improvement in Faisalabad was given higher priority in this policy for earlier realization.

With the background of the project as described in the preceding sections, the progress of the project to date is outlined as follows:

1) The integrated plan for the project covering the whole components requested by the Pakistani side was initially formulated through the basic design study by JICA from 2002 to 2003, and was agreed by both governments in 2004. The plan divided the components into 2 phases; the first phase for the reinforcement of existing distribution network with grant aid, and the second phase for the construction of new major water facilities with the government bond. Phase-1 of the project was successfully completed by March end 2006.

2) In the meantime, the tender for Phase-2 was held in March 2006 with unsuccessful result. Another two tenders followed within the same year, both ending up in failure as well. In this situation the project was faced with the difficulty of completion of the works in that phase by the time of the expiry of Exchange of Notes, which was set in the end of March 2008. The project was eventually terminated with the agreement of both sides.
The main cause of tender failures was in the project cost based upon the estimate prepared during the basic design study in 2003, since the prices of major materials, equipment and labor had been under continued pressure of the global economic fluctuation since the end of 2003, represented by soaring price hikes of steel products and crude oil. Prices of domestic materials and labor in Pakistan had also steeply gone up. Furthermore, in the aftermath of the big earthquake in the northern part of the country in 2005, prices of construction materials and labor had jumped up.

3) Notwithstanding the termination of the project in March 2008, the intention of the Pakistani side to complete the project with cooperation of Japan stayed firm because of priority and importance of the project for one of the largest cities in the country. In response to its renewed request to resume the project, Japan International Cooperation Agency (hereafter called "JICA") carried out the implementation review study for the realization of Phase 2 in July 2007, focused on the renewal of the project cost, together with the examination of the initial design and confirmation of the responsibilities of both sides.

4) Based upon the results of the implementation review study for Phase 2, the Exchange of Notes were concluded between the governments of Japan and Pakistan in July 2008. The tender was held in December that year, to see the unsuccessful result once again. The elaborate review of the new tender price and proposal indicated the direct influence of violent fluctuation of exchange rates under the global financial crisis, which had been raging at the time of tender opening. Prices of major construction materials in the project, particularly steel pipes of Pakistani make had been unstable and affected the total project cost.

5) Subsequent to the repeated failures of the tender under the violently changing economy worldwide, a measure to overcome the situation was consulted between both governments. It was decided that Phase 2 be divided into two projects, with one component for the water source facility separated into an independent project as the Project for the Expansion of Water Supply System in Faisalabad and other components for collector main, transmission and distribution facilities remaining in the Project for Improvement of Water Supply System in Faisalabad, Phase 2.

6) The thus agreed conclusion finally led to the successful result of the tender in November 11 for Phase 2, and its implementation has since been under way at site.

After ensuring the progress of a major portion of the plan for the project, JICA responded to the Pakistani request for the earlier realization of the Project for the Expansion of Water Supply System for Faisalabad, dispatching a team for the implementation review study of the water source facility from December 9 to 24, focusing on the examination of the current situation of the wellfield for the development of planned water source as well as the project cost, as this project is anticipated to be implemented in the later stage of 2011. The team consulted the Pakistani side on its share in the works for the project and the targeted date of approval by the Pakistani government of the revised PC-1 (Planning Commission Document-1), a process required according to its rule for the project approval, now that the total project cost of the ongoing PC-1 has increased through the change of the project framework.

The team later prepared a draft report on the results of the study, and JICA dispatched a draft report explanation team from February 14 to 19, 2010. The team had talks with the representatives of the Punjab government and WASA. The Pakistani side agreed on the proposal from the Japanese side, and

both sides signed the minutes of the meeting. The major items agreed were as follows:

(1) Among the components of the project for construction, it was confirmed by both sides that the Pakistani side should undertake land acquisition for the water source facility, construction of access at site, provision of primary power source to the site and others which had been agreed during the preceding implementation review study for Phase 2 of the project in 2007.

(2) The Pakistani side will take necessary steps for the required process for the revision, application, and approval by the federal government agency regarding PC-1 as the total project cost is to increase from the initial one by more than 15% through the arrangement for the change of the project framework. The Pakistani side pledged to ensure the final approval of CDWP (Central Development Working Party) by mid April 2010.

(3) Both sides confirmed the results of the environmental impact assessment carried out by WASA and approved by the Ministry of Environment, together with the screening results based upon the latest version of JICA's guideline for the same purpose. The Pakistani side agreed to execute necessary environmental monitoring in compliance with the requirements of these guidelines.

The scope of work for the Project for the Expansion of Water Supply System agreed by both parties are summarized in the following table. The outline of the works for the ongoing portion of the project is attached for reference.

Table - 1 Outline of the Project

(1) Project Summary			
1) This Project	Water Source Facility: 25 tubewells (Planned production 91,000 m^3/day)		
2) Phase 2 (Ongoing)	a. Collector main (14.6 km), b. Booster pumping station, c. Transmission main (11.3 km) and (d) Terminal pumping station		
3) Phase 1 (Completed in 2006)	Reinforcement of existing distribution network		
(2) Outline of components			
Project	Category	Facility/Equipment	Specifications
This Project	(1) Water source facility	a) Tubewell 25 Nos. (including standby 2 Nos.)	Basic design depth 160m
		b) Tubewell pump station 25 Nos	Size 45.4 m^2/ea
		c) Tubewell pumps 25 Nos.	Vertical hollow shaft turbine type Capacity 200 m^3/hr/ea
Phase 2	(1) Collecting facility	a) Collector main, Diameter 400 - 900 mm	Steel/ductile cast iron pipe Total length about 14.6 km
	(2) Transmission facility	a) Reservoir 1 No.	Capacity 4,000 m^3
		b) Booster pumping station	Q=25.3m^3/min, 190 kw/unit
		w/booster pumps 5 Nos.	
		c) Chlorination equipment 1 set	Chlorinator w/Cl gas scrubber

		d) Transmission main, Dia.1,000	Steel pipe Total length about 11.3 km
	(3) Distribution facility	a) Terminal reservoir	Capacity 36,000 m^3
		b) Terminal pumping station w/distribution pumps 5 Nos	31.6m^3/min 330 Kw 2 Nos. 63.2m^3/min 660 Kw 3 Nos
Phase 1	(1) Reinforcement of distribution network	a) Distribution pipeline	Ductile cast iron pipe, Total length 6 km
	(2) Procurement of operation & maintenance equipment	a) Tubewell level meter 12 Nos	Potable type
		b) Water analysis equipment 1No	Photo-spectral type
		c) Ph/EC meter 2 Nos	Potable type for field use
		d) TDS meter 2 Nos	Potable type for field use
		e) Voice communication system	
		f) Ultra-sonic water meter 1 No.	
		g) Leakage sound detector 2 Nos.	
		h) Voice communication system 1 set w/ main unit 4 Nos. & VHF handheld transceiver 15 Nos	Communication distance Max. 30 Km

The Project for Improvement of Water Supply System in Faisalabad with its Phase 2 now ongoing is to be completed in March, 2012.

The cost to be borne by the Pakistani side for the Project for the Expansion of Water supply System in Faisalabad is estimated at 509.41 million Rs. The share of the Pakistani side includes the costs for the compensation package programme as social and environmental consideration, access road across the wellfield and provision of primary power supply to 25 tubewell stations. The Project for Improvement of Water Supply System in Faisalabad with its Phase 2 is now underway.

The entire project consisting of the ongoing one and this Project is implemented with Water and Sanitation Agency, FDA, Faisalabad (WASA) as the executing agency. WASA is an independent wing of Faisalabad Development Authority (FDA). The overseeing organization includes the Department of Housing and Urban Development/Public Health Engineering (HUD/PHE) and Planning and Development Board (P&D) of the Punjab government. WASA is headed by Managing Director, including 8 departments for administration and technical services for water and sewerage, with approximately 2,000 employees in 2009. The operation of WASA depends upon tariff revenue for services, based upon the fixed rate system for property size common in all the cities of the country. Without meters at most of households and due to low tariff collection rate due to inferior service, the revenues have been subsidized from urban property tax to cover huge energy cost. However, it has recently launched a new policy under strict control of the provincial government for the improvement of financial management, including raising tariff and gradual shift to metering system. This project is aimed at urgently improving public water service targeting the increased water supply and per capita

supply rate for citizens including large numbers of the poor in a significantly big city of the country. It will contribute to improvement of their basic human needs (BHN) and health environment. All these characteristics of the project, together with effects enumerated as follows, are deemed adequate for verifying feasibility of extending Japan's grant aid to the implementation of the project.

(1) Direct effects

a. The study for the project revealed that presently the water service coverage in Faisalabad is at a level of 55% with a served population of 1,590 thousand among an estimated population of 2,600 thousand, with a per capita daily average supply rate at 89 liters. After an additional water supply of 91,000m^3/day is secured through the implementation of the project in 2012, the coverage will increase to 60% with a served population of 1,890 thousand in an estimated total of 2,948 thousand with a per capita daily average enhanced to 130 liters.
b. The time restricted water supply service (maximum of 6 hours) will change to 4 hours' service provided more than 3 times a day.
c. Extremely poor water service in the east side of the city with one third of the entire city population can be improved with water pressure in the arterial mains in that area increased from current 0.5 kg/cm^2 at the maximum to 1.0kg/cm^2.

(2) Indirect effects

a. The significant increase of safe and stable water supply can contribute to alleviating water-borne diseases such as hepatitis, diarrhea, etc., improving health of citizens.
b. The improved water service and awareness building of payment to the consumers can have effects to raise revenues as it may decrease arrears and rejection of payments of water fees, illegal connections, forced withdrawals with privately owned pumps, etc. The implementation of the project will offer WASA the best chance to shift to a metered tariff system.

Finally it is requested to WASA to take the following measures into account to enhance the effects of the project:

(1) Conservation of the wellfield with monitoring

The augmentation of water supply as the target of this project depends upon the potential of groundwater resource along the Jhang Branch Canal. It has been confirmed by this study that the main source of its recharge is infiltration coming from the canal. Accordingly stable flow through the canal is one of the essential conditions to secure sustainable groundwater withdrawal.

The Jhang Branch Canal is one of the secondary mains of the Lower Chenab Canal, which is the largest in scale in the existing irrigation network of the Indus system. Since the Lower Chenab Canal

system including its intake headwork has now been overage due to its oldest construction, the provincial government of Punjab plans a large-scale rehabilitation work as well as extensive lining of the existing channels for the purpose of securing discharges. This study was informed, however, that the lining is planned for the distributaries and smaller downstream channels, with the trunk mains remaining untouched. The flow through the Jhang branch Canal is not likely to decrease significantly by the implementation of such a plan. This situation seems to guarantee the soundness of water sources for the project for a foreseeable future. Notwithstanding, WASA is requested to pay close attention to the operation of the canal, collecting data and information from the authorities, particularly during the period of its closure, for its proper management of water sources, in order to ensure stable supply of water.

As the most effective measure to protect the quantity and quality of the wellfield, the establishment of periodical monitoring system is essential. The recommended monitoring approach is introduced in this report. Necessary equipment for monitoring, such as tubewell level meters and potable water analysis devices, was already provided during Phase 1 of the Project. WASA is strongly requested to formulate the most pertinent monitoring system and utilize the collected data on water volume, quality and change of water level effectively for the protection of the wellfield.

(2) Necessity of information release and risk management

As a result of the basic design study in 2003 it was revealed there might be a risk of groundwater level lowering in the surroundings of the planned wellfield on the medium to long term basis. WASA, therefore, made close contacts with stakeholders in the area and launched a compensation package project for the concerned villages. As a result of such efforts, pressure from them have been subsided for the moment. When WASA starts the operation of new tubewells there upon completion of the construction work, however, old hostility may be revived among them as the study team encountered during the Basic Design Study in 2002～03. As a measure to prevent such a confrontational situation, constant contacts with stakeholders will be required through the organization of a liaison office involving representatives of WASA, city officials and stakeholders where information and data obtained through monitoring is to be openly provided to ensure their understanding. Occasional public meetings and hearings with villagers in general will also have effects. The environmental impact assessment report prepared for the project by WASA is of a similar opinion.

(3) Efficient water supply by means of reduction of leakage and improvement of distribution

In order to minimize loss of valued water, WASA is required to take aggressive actions to reduce leakage of pipelines which is reportedly at a level of 30%, although the real situation is unknown since house connections have no meters. WASA was forced in 2006 to renew house connections in a colony where a tragic incident happened resulting in 11 casualties of infants due to contamination of water pipes by sewers. After this incident, WASA is poised to replace deteriorated pipelines in other service

areas. Since this measure is especially effective for reducing leaks, WASA is strongly recommended to realize it gradually, based upon a practical plan.

Another effort should be turned to reinforcing the existing network for distribution. As a model case, this project carried out the installation of bypass line intended for the improvement of water pressure in the east area of the city. In addition, various kinds of monitoring and testing equipment for pipeline were provided to WASA. To remedy or rehabilitate the existing network, these devices will be essentially helpful, telling actual pressures and flows in the field. WASA is recommended to use these equipments effectively and realize efficient distribution for the respective service areas.

(4) Shift to metering system

Augmentation of water supply can have its maximum financial effect under the metered tariff system, which WASA undertook for the colony hit by the incident cited in the foregoing clause in combination with the renewal of house connections. WASA is said to have a policy to practice it in other areas where pipe renewals are being planned. The shift of all the current consumers of about 100 thousand is estimated to take more than three years. Since its preparation seems likely to take time, at least WASA should start with new consumers from now on. Earlier realization of the plan is strongly recommended.

(5) Necessity of improvement of financial management

According to the calculation in this implementation review study, the combined operation of distribution pumps for longer hours after the commencement of operation of a new system is likely to cause WASA a huge amount of expenditure for operation and maintenance, particularly energy cost. Since WASA has lately been under strict control and advice from the provincial government for the improved financial management including the shift to the metering tariff, WASA is required to aggressively address challenges to its financial management and establish a balanced financial base for reliable service.

(6) Revision of PC-1

For the implementation of the project, WASA pledged its share of undertakings such as instattion of high-tension primary power connections for the tubewell stations, access construction across the wellfield, execution of a compensation package project, land acquisition cost, etc. The fund for these responsibilities on the Pakistani side is granted to WASA by the government, based upon its application called PC-1 which is to be approved through the official channel of the provincial and federal governments. At the onset of the preceding implementation stage, PC-1 was already ensured. However, the newly revised project cost requires the review of the plan and budget through the same process. Since the Japanese side needs the approval of PC-1 for its final approval by mid April 2010,

the Pakistani side is requested to follow the process with close attention to meet the required deadline.

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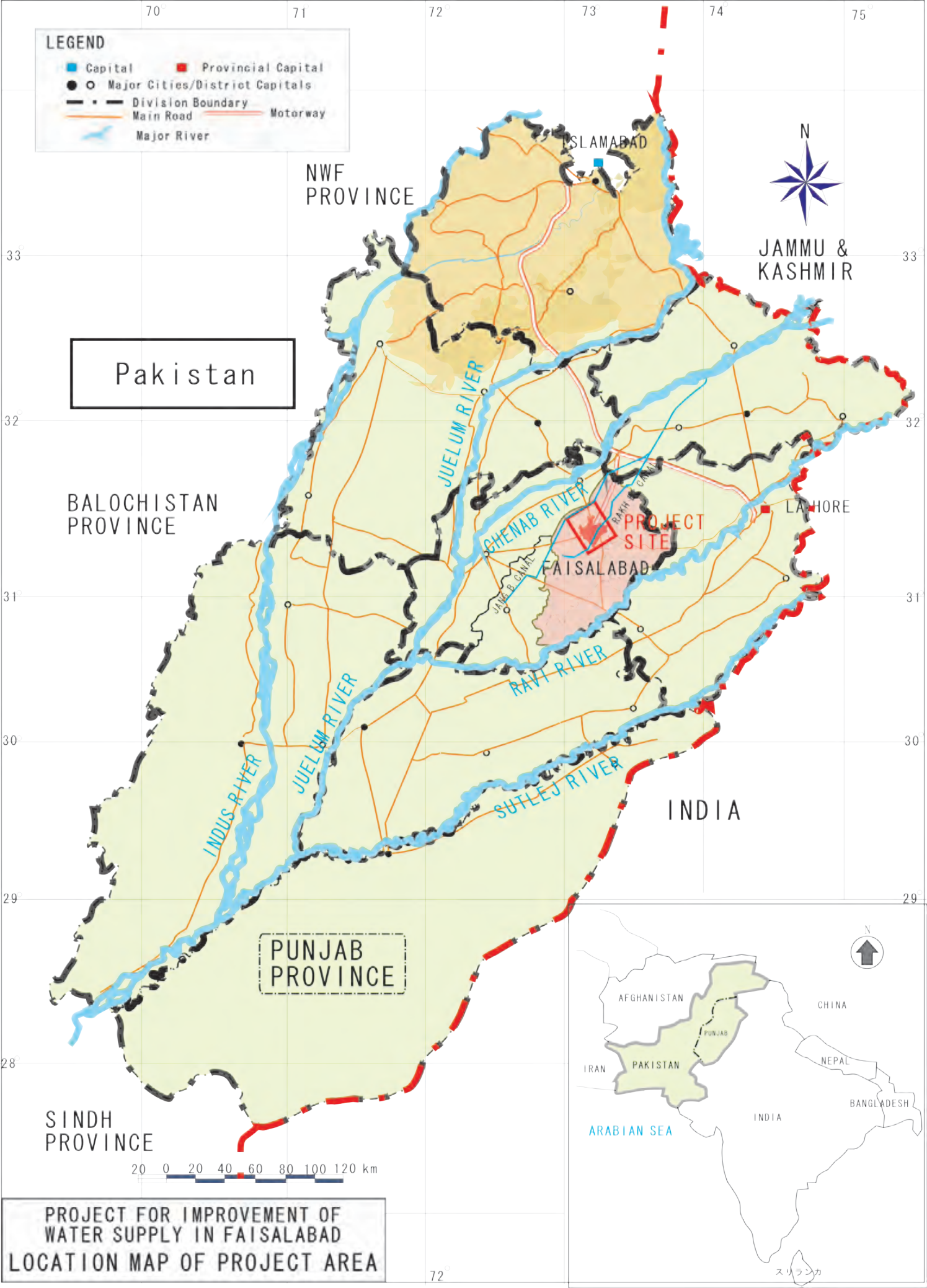
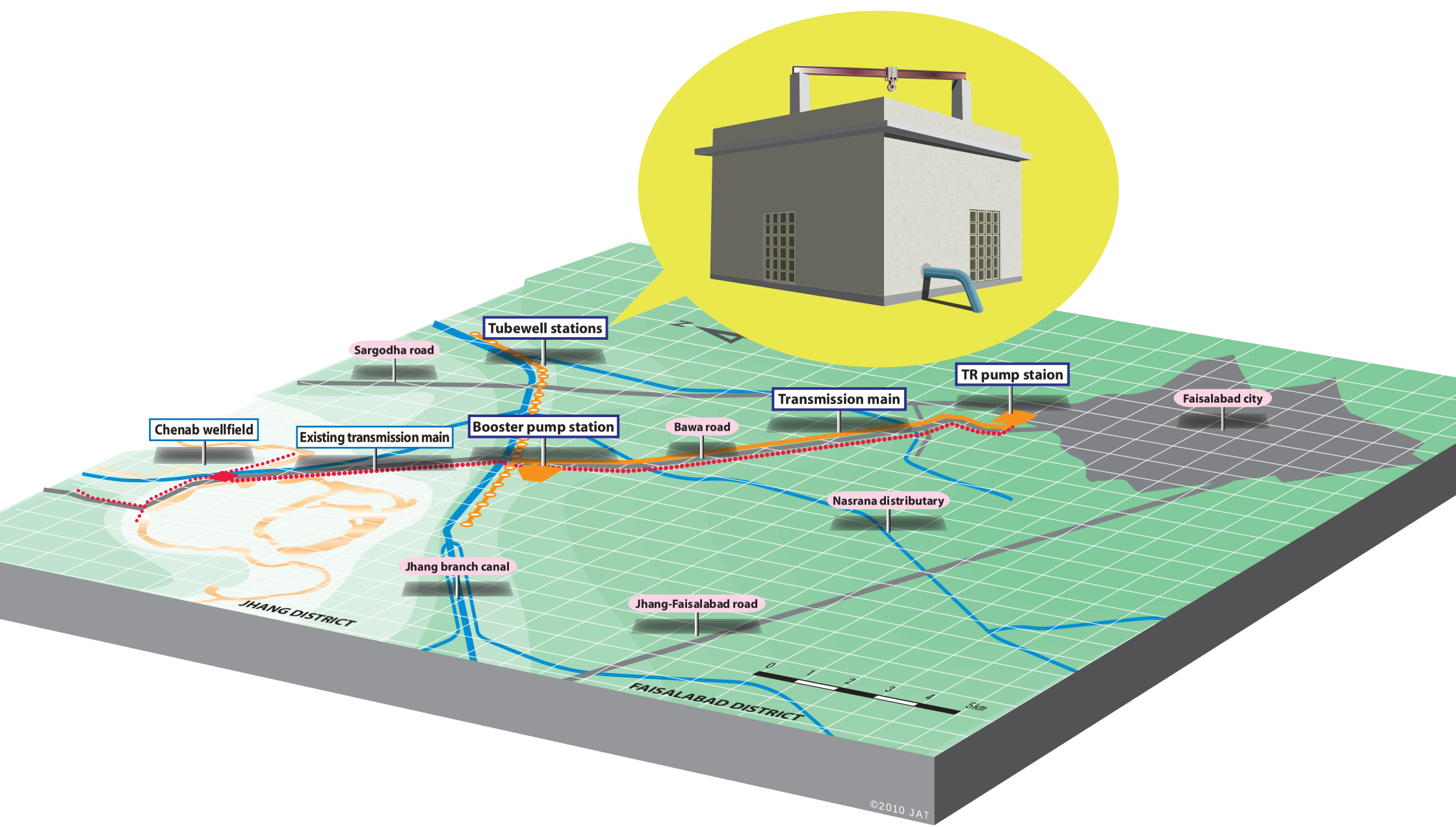


PROJECT FOR IMPROVEMENT OF WATER SUPPLY IN FAISALABAD

LOCATION MAP OF PROJECT AREA


Tubewell stations
Sargodha road
Chenab wellfield
Existing transmission main
Booster pump station
Bawa road
Transmission main
TR pump staion
Faisalabad city
Nasrana distributary
Jhang branch canal
Jhang-Faisalabad road
JHANG DISTRICT
FAISALABAD DISTRICT
0 1 2 3 4 5km
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ABBREVIATIONS

ADB	Asian Development Bank
A/P	Authorization to Pay
API	American Petroleum Institute
AWWA	American Water Works Association
B/A	Banking Arrangement
BS	British Standards
DfID	Department for International Development
DIN	Deutsches Institut für Normung e. V.
ECNEC	Executive Committee of National Economic Council
E/N	Exchange of Notes
FDA	Faisalabad Development Authority
GL	Ground Level
HUD/PH	Ministry of Housing, Urban Development and Primary Health
HWL	High Water Level
IEC	International Electrotechnical Commission
ISO	International Organization for Standardization
JICA	Japan International Cooperation Agency
JIS	Japanese Industrial Standards
LCC	Lower Chenab Canal
LWL	Low Water Level
PC-1	Planning Commission Document-1
PKR	Pakistan Rupees
PVC	Polyvinyl Chloride
REC	Republican Engineering Co.
TDS	Total Desolved Solids
T/R	Terminal Reservoir
WAPDA	Water and Power Development Authority
WASA	Water and Sanitation Agency
WHO	World Health Organization

CHAPTER 1
BACKGROUND OF THE PROJECT

Chapter 1 Background of the Project

1-1 Overall Goal and Project Target

This study is aimed at examining and confirming various conditions for the satisfactory implementation of the “Project for the Expansion of Water Supply System in Faisalabad" targeting to provide facilities for groundwater development and its intake in combination with the ongoing “Project for the Improvement of Water Supply System in Faisalabad”. The works in the project under this study were previously included in the latter one as one of its main components. The initial concept of the preceding project since its onset in 1997 was to complete an integrated water supply system comprised of facilities for water source development, conveyance, transmission and distribution for the city to augment the capacity of the existing system by 91,000 m^3/day. The realization of the project since then, however, encountered diverse difficulties, financial pressures in particular under the radical change of the global economy. Consequently it was agreed between the governments of Japan and Pakistan in 2009 to divide the initial framework of the project into two parts: one for the component of water source facilities and the other for the rest of planned water supply facilities. After this measure was taken, the tender for the latter package of the project turned out successful. Finally the remaining portion of the project for the component of water source facilities is intended to be implemented to fulfill the initial target of the entire project in response to the request of the Pakistani side.

The population of Faisalabad city is now prospected to reach 3 million soon, the third largest in the country following Karachi and Lahore. However, the citizens have long been suffering from shortage of water supply. This project, together with the ongoing one, aims to alleviate its acute shortfall of water supply due to dramatically increasing population in the industrial sector, especially in thriving textile industry.

Like Lahore and other major cities in the country, Faisalabad largely relies upon groundwater resources for its water supply except a very small portion of the area where slow sand filtration is employed, using the canal water. The initial master plan for city's environmental infrastructure for water and sewerage was worked out by ADB in 1970's, and the planned main water facilities were installed with its assistance in 1992, with its wellfield located in the basin of the Chenab River about 20 to 25 km northwest of the city. They have since then been working as the main sources for the city, accounting for nearly 90% of the ongoing supply.

The additional new wellfiled to be developed under this project is planned along the channel of the Jhang Branch Canal, running westwards about 13km northwest of the city. Groundwater potential was confirmed to be enough for planned production of 91,000 m^3/day during the previous basic design study in 2003. However, its development needs to take into account environmental and social impact, since the wellfield lies amidst fertile farmland in the Chenab basin fed by the canal from the Chenab river. The measures to eliminate its adverse effect will be examined later, based upon the results of the Environmental Impact Assessment (EIA) undertaken by the Pakistani side. The study also needs to confirm the current project cost for the realization of the project under widely varying economic environment.

1-2 Progress of the Project

This project will contribute to improving the water supply system in Faisalabad, jointly with the preceding one now under construction. The following table 1-1, reviews the progress of the entire project, which started in 1997 with the preliminary study by JICA, targeting to provide an integrated water supply system. The background of the current situation of the project, which has been divided into the two parts, can be traced in this progress.

Table 1-1 Outline of the Progress of the Project before This Study

	Date	Description of Assistance	Explanation
1.	1997	Preliminary Study for "the Project for Improvement of Water Supply System in Faisalabad	
2	1998	1st Basic Design Study	Cancelled on the way due to the economic sanction imposed on Pakistan due to its enforcement of nuclear testing.
3	Dec. 2002 to Feb. 2003	2nd Basic Design Study (1st stage)	Cancelled as well due to intensified objection to groundwater development by residents in and around the selected wellfield for the project.
4	Aug. 2003 to Sep. 2003	2nd Basic Design Study (2nd stage)	The study (2) was satisfactorily completed after an alternative wellfield was proposed by the Pakistani side.
5	Mar. 2004	Basic design draft explanation mission	The results of the basic design study were agreed between the mission and the Pakistani side and the implementation of the study was divided into two phases (phase 1 and phase 2).

6	Jan. 2005	Commencement of the implementation of the project with the detailed design study for Phase I after ECNEC's approval in Oct. 2006 and the subsequent conclusion of Exchange of Notes between the both governments for Phase 1	The works for Phase 1 of the project consisted of the works for improving the existing distribution network of the city.
7	Jun. 2005 to Dec. 2005	Detailed design study for Phase 2	Phase 2 consisted of construction of main water facilities for augmentation of water supply.
8	Jul. 2005 to Mar. 2006	Construction works for Phase 1	The works for Phase 1 was successfully completed by March end, 2006.
9	Mar.,Jul. and Oct., 2006	Tenders for Phase 2	All the three sessions of tendering for Phase 2 turned out failure. Finally in March 2007, the implementation was forced to be closed due to the expiry of the exchange of notes.
10	Jul. 2007	Implementing review study for Phase 2	In response to the request for resuming the project by the Pakistani side, the mission carried out the study for realization of the project implementation.
11	July 2008	Exchange of Notes for modified Phase 2	
12	Jan. 2009	Tendering for Phase 2	The tender for Phase 2 resulted in failure again.
13	Jul. 2009	Agreement by both governments on the change of the project framework	As a measure to overcome the influence of the global economic fluctuation, it was decided to divide the initial project framework into two, with one for Phase 2 covering components for collection, transmission and distribution and the other for the component of water source facility.
13	Nov. 2009	Tendering for Phase 2	Finally the tender for Phase 2 turned out successful, and implementation of works started.
14	Dec. 2009	Implementing Review Study for the Project for the Expansion of Water Supply System in Faisalabad (This study)	It is aimed at finalizing the plan for the separated component of water source facility as an independent project. .

1-3 Environmental/Social Consideration

The Pakistan Environmental Protection Act was issued in 1997, with revisions and new provisions added to it to date. According to the provisions for IEE and the review of EIA criteria, the water supply projects with fund more than 25 million Rupees are required to carry out EIA (Environmental Impact Assessment). In compliance with this requirement, this project completed it in 2007. WASA submitted its EIA report on March 19, 2007 and was approved by Environment Protection Agency (EPA) of the Punjab government on March 19, 2008. This approval has since been valid for the project.

Accordingly this project will be implemented, following the conclusion of EIA and the requirements of EPA as conditions for its approval to mitigate negative impacts likely to be caused by the implementation of the project through various arrangements for preventive measures, as listed in Table 1-2 "Physical/Social Environmental Assessment List" and Table 1-3 "Monitoring Plan". WASA, the consultant and the contractor will jointly be responsible for actions to meet the requirements in both environment protection and monitoring plan.

Table 1-2 Physical/Social Environmental Impact Assessment List

Name of Executing Agency: Water and Sanitation Agency, FDA, Faisalabad

Cate-gory	Environmental Component	Environmental Questionnaire	Confirmed Measures
1. Approval & public relations	(1) EIA and Environmental Approval	a. Have the EIAR already been prepared? b. Have the EIAR been approved by the government ? c. Is the approval of the EIAR without any conditions ? In case of approval with conditions, can they be cleared? d. Have the EIAR been approved by the local authorities, in case it is required?	a. The EIAR was prepared in 2007. b. The EIAR was approved by the Environment Protection Agency of the Punjab government on March 19, 2008. c. The conditions for approval are measures for mitigation of impact, which will be responded later during the course of the project implementation. d. Not applicable.
	(2) Public relations with local residents	a. Will the responsible authorities hold public meetings with local residents for ensuring their understanding on the contents and impacts of the project? b. Will the requirements of local residents and concerned offices be responded?	a. After the release of information on the project through newspapers, there was an outbreak of public demonstration of local residents against the implementation of the project. The government side held public meetings with them several times for explanation of plans to mitigate their apprehension of water level decline. b. A compensation package programme amounting to a sum of 45 million Rps was already carried out for the villages likely to be affected by the project implementation after public hearing with the local residents. Continued contacts with such stakeholders have satisfied their requirement on the information about the project.
2. Measures to protect against contamination	(1) Air quality	a. Is there no risk of air pollution with Cl_2 gas leak from its injection/storage facilities? Does treatment of Cl_2 gas in work place meet the standards for work safety measure?	Not applicable in the scope of this component of the project.
	(2) Water quality	a. Does the quality of waste water generated by the operation of facilities meet the criteria for waste water effluent?	Not applicable
	(3) Waste	a. Does the treatment/disposal of waste such as sludge generated by the operation of facilities comply with the criteria for waste disposal?	Not applicable
	(4) Noise, vibration	a. Does the noise/vibration of running facilities such as pumps comply with the country's standard regulations?	Facilities are located far from the residential area. Noise level will have no adverse effect to residents.
	(5) Land subsidence	a. Is there any risk of land subsidence due to pumping of large quantities of groundwater?	The existing wellfield has been free from the phenomenon of land subsidence despite continued withdrawal of groundwater in large quantities. Similar technical design to minimize the decline of water level will be adopted in this project, and can prevent a risk of land subsidence (employment of good quality screen to prevent sand pumping, etc)

3. Environment	(1) Conserved reserve area	a. Is the project site located within the premises of a natural reserve appointed by the country's law or international treaty? Or is such a reserve free from environmental impact of the project?	a. The project site does not include the natural reserve.
	(2)Eco system	a. Is there a primeval forest, tropical rain forest, or ecologically important habitat (coral reef, mangrove trees, tidal flats, etc)? b. Does the project site include a habitat to be protected under the country's law or international treaty? c. Does the withdrawal of water resources (surface water or groundwater) in the project affect the aquatic life in water body such as streams? Does the project include any measure to mitigate impact on aquatic eco-system?	a. The project site does not include any such type of area. b. The project site does not include it. c. Not applicable d. No intervention in aquatic life.
4. Social environment	(1) Displacement	a. Will the involuntary displacement of local residents occur due to the implementation of the project? In case it occurs, is there any measure taken to minimize the influence of displacement for residents? b. Will the residents receive adequate explanation on the displacement and compensation prior to displacement? c. Will the survey for displacement be undertaken for formulating a displacement plan for proper compensation and recovery of basis of livelihood after displacement? d. Does the displacement plan include proper measures for the socially weak groups such as women, children, the aged, the poor, minorities, aborigines, etc.? e. Will the agreement of residents for the displacement be ensured before its implementation? f. Will the project be able to set up an organization to implement the displacement effectively together with arrangements for sufficient budget? g. Is there a plan for monitoring the impact of displacement?	a. Displacement does not occur in this project. b ~ g Not applicable since the acquisition of private land is not required.
	(2) Life and livelihood	a. Is the project likely to produce adverse effect on the life of residents? Is it possible to arrange measures to mitigate it, in case it is required? b. Will the withdrawal of water resources (surface water or groundwater) by the project affect the existing water use practice in the area?	a.b. The withdrawal of large quantities of groundwater in this project is likely to cause the decline of groundwater level across the project site, which may affect a part of private wells. Accordingly this project adopt technical arrangements in the design of tubewells and their layout in the wellfield to minimize the decline of water level. In case the decline should occur despite such arrangements, the increase of distribution of irrigation water from the canal will be planned.

	(3) Cultural heritage	Will any archaeological, historical, cultural or religious heritage be free from damage due to the project? Will protective measures be provided to such facilities in a manner prescribed under the national law?	Not applicable
	(4) Landscape	Is there any adverse influence to a specific landscape to be preserved in and around the site?	Not applicable
	(5) Minorities/ aborigines	a. Will the project comply with the law to protect the right of minorities/aborigines? b. Will the project arrange to mitigate the adverse effects on the culture and life style of minorities/aborigines?	Not applicable
5. Others	(1)Impact during construction stage	a. Has the project prepared a plan to mitigate adverse environmental effects such as noise, vibration, muddy flow, dust, gas exhaust, waste, etc.? b. Will the project be able to avoid adverse effect to eco-system during the construction work? c. Will the project be able to avoid adverse effect to social environment? Will the project prepare measures to mitigate such adverse effect whenever required? d. Will the project undertake training program of labor regarding traffic safety, public health, etc according to the needs during the works?	a. A plan for measures to mitigate adverse impacts to the public in and around the site has been prepared. The contractor will observe the guidelines in the plan under the control and supervision of the consultant. b. Not applicable in this project. c. Pipe installation work along the public roads may create adverse impacts to the public life during works. Measures to mitigate such effects include to minimize dust with frequent water sprinkling, to control traffic with proper posting of staff on traffic duty and safety devices and warning signs, etc. d. Training of labor will be carried out from time to time regarding traffic safety, public health and other security matters.
	(2) Monitoring	a. Will the executing agency plan and undertake a monitoring program of the aforementioned environmental components which may more or less be affected by the project implementation? b. Are the details of such monitoring program (items, method, frequency, etc.) suitable for the intended purpose? c. Will the executing agency organize a proper setup for the planned monitoring program (team, staff, budget, and their sustainability) ? d. Is there an established rule for the details in reporting (formality, frequency, etc) by the executing agency to EPA on the monitoring results ?	a. It will carry out the monitoring program of groundwater level. b. Details will be examined and decided in the later stage. c. Water levels will be monitored by the operators of the executing agency. They have been in charge of monitoring of existing tubewells. For the new project, they can train and supervise the new operators for monitoring. d. The monitoring report will be submitted monthly to the authorities in compliance with the requirements of the conditions for the approval of EPIR.
6. Remarks	Remarks for the assessment list	a. When it deems necessary, cross-boundary or global environmental impact may also be confirmed (in case of factors related to cross-boundary waste disposal, acid rain, disruption of the ozone layer, global warming effect, etc.)	Not applicable.

Table 1-3 Monitoring Plan

[During the construction stage]

Monitoring components	Venue	Frequency	Method/criteria	Officials in harge	Responsible organization	Reporting To:
Safety control	Roads, villages, public institutions such as schools/ hospitals in and around the construction site	Whenever works are in progress around/ At Regular safety meetings	Inspection with reference to the contractor's safety control plan	WASA Counterparts /consultant	WASA	EPA
Technology transfer to WASA counterparts & local contractors	Construction sites	During the progress of works and upon completion of major items of works	Inspection of technical training of local contractor's staff/labor by the Japanese experts during the works and the test operation of completed facilities	WASA Counterparts /consultant	WASA	EPA
Setup of supporting system for health/safety control	Construction sites	Before starting any major work/at regular safety control meeting	Inspection with reference to the contractor's safety control plan	WASA Counterparts /consultant	WASA	EPA
Materials control and management	Stockyard	During the progress of works	Inspection of materials in stock Confirmation of practice of stock material control and yard cleaning	WASA Counterparts /consultant	WASA	EPA
Traffic safety	Construction sites	During the progress of works	Supervision/cooperation of local traffic police will be ensured for traffic control measures undertaken by the contractor according to his traffic control plan. Inspection of officials in charge	WASA Counterparts /consultant	WASA	EPA
Compliance with EIA conditions		Before starting the construction works	Copies of EIAR will be provided to the contractor, and detailed discussions for compliance will be held.	WASA	WASA	EPA
Water sprinkling over unpaved road	Construction sites	During the progress of the works	Inspection	WASA Counterparts /consultant	WASA	EPA
Construction waste & debris	Construction sites And dumping sites	During the progress Of the works Once in a month	Inspection	WASA Counterparts /consultant	WASA	EPA
Noise and vibration	Construction sites	Whenever and wherever it seems necessary while the works are in progress	Inspection	WASA Counterparts /consultant	WASA	EPA

[During the operation and maintenance stage after commissioning]

Monitoring components	Venue	Frequency	Method/criteria	Officials in charge	Responsible organization	Reporting To:
Groundwater level	Tubewell pump stations	Daily measurement	Measurement with suitable water level meter.	WASA operators	WASA	EPA
Water quality	Tubewell pump stations (and Surrounding private tubewells when it seems necessary.	Once in 3 months	Chemical analysis by WASA laboratory	WASA Experts at laboratory	WASA	EPA

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CHAPTER 2
CONTENTS OF THE PROJECT

Chapter 2 Contents of the Project

2-1 Basic Concept of the Project

The initial request by the government of Pakistan to Japan for the Project for Improvement of Water Supply System in Faisalabad dates back to the year of 1995. The entire framework of the project then agreed by the both sides was comprised of a comprehensive system of water source, collector main, transmission and distribution facilities for augmenting city's water supply by 91,000 m^3/day. With the facilities of each component in the project in large scale requiring huge fund, the project has undergone twits and turns during the course of implementation to date including successive tender failures under influence of political and social conditions of the recipient country as well as continued radical fluctuation of global economy. After it was agreed by both the governments to separate one of the major components for the provision of water source facilities from the initial framework of the project, the tender was successfully concluded, and the implementation has now been underway. The current task to achieve the target of the project is to finalize the design for the water source facilities as a sole remaining component of the project, which is yet to be realized. This implementation review study, therefore, was aimed at concluding the scope of renewed Japanese assistance and the design for this component, together with the review of the current project cost.

The current study for the Project for the Expansion of Water Supply System in Faisalabad" reviewed all the preceding agreements by the both governments regarding the targeted component for the construction of water source facilities in the past studies by JICA: the basic design study in 2002 to 20004 and the implementation review study in 2007 for Phase 2 of the Project for Improvement of Water Supply System in Faisalabad. As a result of the study, it is concluded that the component of water source facilities can be implemented as an independent project with most of the previous conditions for the said facilities as they were agreed. Japanese assistance for this new project is to cover the following works:

1) Tubewells	25 nos. (including 2 standbys, each with a production capacity of 4,000 m^3/day)
2) Tubewell pump stations	25 nos.
3) Tubewell pumps	25 nos (vertical shaft submersible pumps, driven with vertical electric motors of maximum output of 60 kW, 3 phase, 400V)
4) Piping work for pump discharge	25 nos.
5) Internal electrical work	25 nos.

On the other hand, the Pakistani side undertakes the following works:

1) Securing land for the construction of facilities of tubewells/stations of 25 in number
2) Construction of access roads to water facilities (for tubewell pump stations, approximately 16 km)

3) External electrical works for primary power supply up to tubewell stations (11 kV～400V)
4) Any works other than the undertaking by the Japanese side.

Table 2-1 shows the comparison of the components of the project agreed in the studies carried out so far. The location of the project area is shown in Figure 2-1, together with locations of facilities already completed and underway.

Table 2-1 Comparison of Major Components of the Previous Studies and This Study

	Basic Design Study for the Project for Improvement of Water Supply in Faisalabad (2003)		Implementing Review Study for Phase II of the Project for Improvement of Water Supply in Faisalabad(2007)		Implementing Review Study for the Project for the Expansion of Water Supply System in Faisalabad (This Study in 2009)	
	Facility Name	Specifications	Facility name	Specifications	Facility name	Specifications
(1)Water source/Intake	①Water sources	Tubewells 25 nos. (2 nos. for standby) Basic depth 160m	①Water sources	Same as in BD	①Water sources	Same as in BD (25 tubewells of basic depth 160m)
	② Intake facilities		②Intake facilities		②Intake facilities	
	a. Tubewell pump station	25 nos. @45.4 m^2	a. Tubewell pump station	Same as in BD	a. Tubewell pump station	Same as in BD (25 nos. of 45.4 m^2
	b. Tubewell pumps /electrical works	25 nos.Capacity:@200 m^3/hr Vertical line-shaft type	b. Tubewell pumps /electrical works	Same as in BD	b. Tubewell pumps /electrical works	Same as in BD (25 nos, @200m^3/hr)
	③Operation quarters	1 no. 170.0m^2	③Operation quarters			
(2)Collection	①Collector main	Dia. 400～900mm x 1.6 km long Ductile cast iron/ plastic-lined steel pipes	①Collector main	Dia. 400～900 mm x 14.6 km	①Collector main	In the implementation stage, based on results of the study in 2007
(3)Transmission	①Booster pump station		①Booster pump station		①Booster pump station	
	a. Pump station	1 no. x 415.8m^2	a. Pump station	Same as in BD	a. Pump station	In the implementation
	b. Booster pumps	@25.3m^3/min x 4 nos. (one for standby)	b. Booster pumps	Same as in BD	b. Booster pumps	stage
	c. Chlorinator	1 unit（chlorinator & appurtenant facilities)	c. Chlorinator	Same as in BD	c. Chlorinator	Ditto
	d. Secondary power supply/connection	3p, 11kV～3.3kV～ 400V, 1p, 240V	d. Secondary power supply/connection	Same as in BD	d. Secondary power supply/connection	Ditto
	②Reservoir	1 no. x 4,000m^3	②Reservoir	Same as in BD	②Reservoir	under implementation
	③Operation quarters	1 no. x 170.0m^2	③Operation quarters	(To be borne by Pakistani side)	③Operation quarters	(To be borne by Pakistani side)

	④Transmission mains	Dia. 1,000mm x13 km long, Plastic-lining steel pipe	④ Transmission mains	Same as in BD except length of 11.3 km	④Transmission mains	In the implementation stage
(4)Distribution	①Terminal reservoir	1 no. x 36,000m^3	①Terminal reservoir	Same as in BD	①Terminal reservoir	under implementation
	②Terminal pumping station		②Terminal pumping station		②Terminal pumping station	
	a. Pump station	545.8 m^2	a. Pump station	Same as in BD	a. Pump station	under implementation
	b.Distribution pumps	31.6m^3/min x 4 nos. (1 no. for standby)	b. Distribution pumps	31.6m^3/min x 2 nos. 63.2 m^3/min x 3nos.	b. Distribution pumps	under implementation
	c. Secondary power supply	3p, 11kV～3.3kV～ 400V, 1 p, 240V	c. Secondary power supply	Same as in BD except increase of power supply to pumps	c. Secondary power supply	under implementation
	d. Operation quarters	1 no. x 170.0m^2	d. Operation quarters	(To be borne by Pakistan side)	d. Operation quarters	(To be borne by Pakistan side)
	③Reinforcement of Exist. distribution network	Dia. 700～800 mm x 6km long, Ductile cast iron pipe	③Reinforcement of Exist. distribution network	(Completed by March 2006 in the preceding implementation during Phase I.)	③ Reinforcement of Exist. distribution network	(Completed by March 2006 in the preceding implementation during Phase I.)

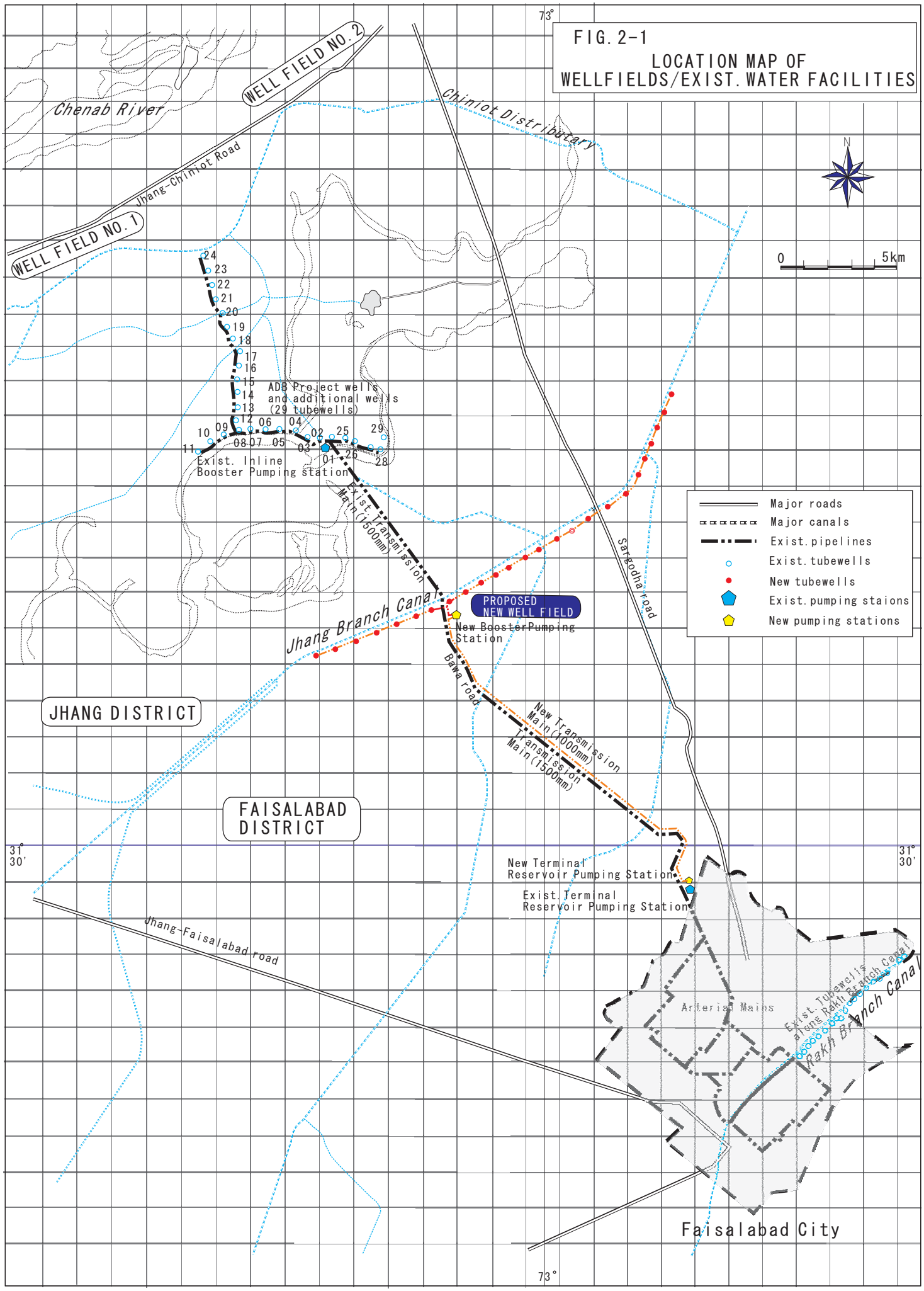
FIG. 2-1
LOCATION MAP OF
WELLFIELDS/EXIST. WATER FACILITIES
73°
WELL FIELD NO. 2
WELL FIELD NO. 1
Chenab River
Chiniot Distributary
Jhang-Chiniot Road
N
0
5km
24
23
22
21
20
19
18
17
16
15
14
13
12
ADB Project wells
and additional wells
(29 tubewells)
10
09
06
04
02
25
29
11
08
07
05
03
01
26
28
Exist. Inline
Booster Pumping Station
Exist. Transmission
Main (1500mm)
Major roads
Major canals
Exist. pipelines
Exist. tubewells
New tubewells
Exist. pumping staions
New pumping stations
Sargodha road
PROPOSED
NEW WELL FIELD
New BoosterPumping
Station
Jhang Branch Canal
Bawa road
JHANG DISTRICT
New Transmission
Main (1000mm)
Transmission
Main (1500mm)
FAISALABAD
DISTRICT
31°
30'
New Terminal
Reservoir Pumping Station
Exist. Terminal
Reservoir Pumping Station
Jhang-Faisalabad road
Arterial Mains
Exist. Tubewells
along Rakh Branch Canal
Rakh Branch Canal
Faisalabad City
73°

2-2 Outline Design of the Requested Japanese Assistance

2-2-1 Design Policy

2-2-1-1 Basic policy

(1) Site selection for development of tubewells for the project

The candidate for the wellfield in the project was initially selected in a basin along the Chenab river as had been proposed in the World Bank's Master Plan, which is located about 30 km northwest of Faisalabad city in the neighborhood of the existing Chenab wellfield developed by the ADB project. Potential of groundwater in the candidate site had been verified by the performance of these existing tubewells in the Chenab wellfield. However, continued pumping of large quantities of production from 25 tubewells there had resulted in the fall of regional groundwater level affecting the surrounding agricultural wells in private use.

Faced with persistent opposition by villagers in Chenab basin to a new project since the start of the study in the end of 1990s, it was finally shifted to an area about 13 km west of to the city, along the left side of the Jhang Branch Canal. The study of the new site proved it to have as high a potential of groundwater of good quality as the previous site did, thanks to ample recharge from the canal. The planned tubewells were anticipated to maintain the estimated production capacity and good quality.

The Jhang Branch Canal is a secondary main of the Lower Chenab Canal (hereafter called "LLC") withdrawing the flow of the Chenab at the Khanki Head Works, the oldest weir of the country, about 150 km upstream the project area. The authorities entertain a plan to rehabilitate the head works and channels of this system to increase and ensure its sustainable supply, since it has now been aged and degraded. One of the measures in planning is to carry out the lining of existing channels to reduce leakage. It was confirmed, however, such works exclude the main stream of the Jhang Branch Canl and are intended for smaller ones such as distributaries and their downstream. In the future, therefore, the canal is expected to be able to feed more water to farms, while groundwater is likely to receive constant recharge along the main channels of the canal including the Jhang Branch Canal. This situation indicates the planned wellfield along the canal can ensure sustainable development of groundwater for the city's water system.

Meanwhile, taking into account the previous experience of WASA in the development of the Chenab wellfield, which had resulted in hostile relations with residents in and around the site, proper measures should be taken to contain influence of additional pumping to a minimum level both in technical design and from a viewpoint of public relations. (Refer to item 2-1-3 "Policy for environmental and social arrangements")

(2) Basic design rate for groundwater development in the project

The design of the water source facilities in this project will be based on the design rate of groundwater development for the project -- 91,000m^3/day. Referring to the overall goal in the 1993 World Bank Master Plan, this rate was proposed in the initial request by the Pakistani side and was agreed by both sides in the preliminary study by JICA in 1997. With no substantial development projects implemented in Faisalabad since then, water demand is now as high as twice of that in the initial stage of the project, but this design rate has continuously been set as a target design rate of this project. Under such a situation WASA is now facing keen necessity of reviewing and overhauling the 1993 Mater Plan for future planning.

One of factors in the background for this longstanding rate of groundwater development is a consensus in 2005 regarding groundwater development in the site by the project between the official side of the regional government and stakeholders surrounding the site, which was reached after an intensified conflict between them since the latter was keenly afraid of the regional decline of groundwater level. During the negotiations between them the technical details and measures of minimizing the fall of the water level were discussed and agreed. To increase the quantity of development in the site after this consensus remains hard. As a result, the implementation review study in 2007 for the 2nd phase of the project concluded on the same design rate, and the study this time in 2009 followed the suit.

Meanwhile WASA is now taking various steps for realizing another projects to meet shortfall of water supply with support of provincial government and other donors. The completion of the ongoing project with Japanese assistance and the subsequent realization of projects with another sources are expected to largely improve the current difficulties of water supply in the city.

2-2-1-2 Policy for natural condition

Water supply in this project for Faisalabad with a population of about 2 million utilizes mainly groundwater as its water source like provincial capital, Lahore, with a population of 6 million. For the city groundwater sources are rich in quantity and good in quality, and has an advantage over any other types of sources in that it can be served only with chlorination, making the cost by far less. This ample source is mainly produced through recharge of artificial canals as one of specific features in a vast tract of Indus plain where agriculture is thriving thanks to widespread network of canals.

The policy for design for the layout of planned tubewells, therefore, pays respect to the recharge of the canal. Major elements, such the numbers of tubewells to ensure the targeted discharge, their spacing are decided, based upon the test results of the canal infiltration, which have been made available through the efforts by WASA.

Since these factors are closely related to groundwater level, which has been a focus among concerned

villages, a unit discharge rate from one tubewell is to be decided within an allowable range of recharge from the canal to keep the fall of groundwater level to a minimum level.

2-2-1-3 Policy for environmental and socio-economic arrangements

The project site where groundwater development is planned is one of typical agricultural areas in the Punjab province, which took shape through colonization after the networks of canals from the Indus system were installed during the British reign in the latter part of the 19th century. Although agriculture in Indus plain has mainly been relying upon canals, canal water distribution is reportedly inadequate. For such a reason, the combined use of canal water and groundwater from tubewells has lately gained force. In fact irrigation tubewells abound in the project site. According to the survey by WASA, there is a private tubewell per 1 km^2 of the area surrounding the wellfield on average. The development of groundwater in an area crowded with existing tubewells entails due consideration to regional agriculture.

This project proposes a design for groundwater development which will limit influence to private tubewells to a minimum level, based upon the analysis of the test results of the canal infiltration. Nevertheless the detailed hydrogeological analysis of the study alarms a risk of probable fall of regional groundwater level on a medium to long term basis. Therefore, WASA is recommended to take the following actions:

a. WASA shall establish an appropriate monitoring programme of groundwater level and quality in the region from the onset of the operation of its tubewells to examine any change in these factors for assessment of influence(including the range and the level of impact).
b. WASA will work out appropriate measures including compensation for management of real risk of occurrence of influence against to which villages in the surroundings have been alarmed. (WASA considers a critical range of fall of level is 3 m, more or less.)
c. WASA will hold public meetings involving all the stakeholders around the wellfield to provide them with necessary information and ensure their agreement through discussions.

(Discussions were held with the Pakistani side during this study, and it was decided that the Punjab Provincial Government, being the overseeing organization of the Project, will take the leading role in the implementation of these measures.)

Regarding the social arrangements, this implementation review study in July 2007 confirmed that WASA already undertook a compensation package program agreed between the government side and the local stakeholders. This programme consists of 38 small to medium sizes of sub-projects mainly targeting environmental improvement in concerned villages around the wellfield. WASA has already completed them to date.